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REVIEW ARTICLE

Childhood Obesity and Dental Disease: Combined Role of the Pediatrician and Pediatric Dentist

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Abstract:

Dental caries and obesity represent growing epidemics in the child population. Obesity in childhood can lead to a host of medical and emotional problems in adulthood. Dental caries can have significant detrimental effects on a child's growth due to impairment of oral functions. Since a child regularly encounters pediatricians throughout childhood, it is important that pediatricians be aware of the possible correlations between obesity and dental disease. The purpose of this article is to review the causes of childhood obesity, discuss the relevance of obesity to dental disease, and highlight some of the actions pediatricians and pediatric dentists can conjointly adopt to prevent and decrease the risk of both these diseases.

Keywords: overweight, fatness, metabolic syndrome, exercise, adiposity

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Introduction

Obesity is the outcome of a disparity between energy expenditure and caloric intake. Overweight and obesity are multifactorial conditions involving physiological, biochemical, metabolic, anatomic, psychological, and social alterations.¹ In simple terms, obesity is a concept of an excess amount of body fat in proportion to lean body mass. The most reliable noninvasive and indirect measure of body fat is body mass index (BMI), which is defined as a person's weight in kilograms divided by the square of his or her height in meters.²

BMI-for-age percentiles, representing eating habits in children and teenagers, are used to assess body fat. BMI-for-age (weight in kilograms/height in meters²) percentiles are dependent on gender- and age-specific weight for height curves for those 2 to 20 years old. According to these curves^{3,4}

1. 'Underweight' is defined as BMI-for-age less than the fifth percentile;

2. 'Normal' is defined as BMI-for-age greater than or equal to the fifth percentile and less than the 85th percentile;

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3. 'At risk of overweight' is defined as BMI-for-age greater than or equal to the 85th percentile and less than the 95th percentile; and

4. 'Overweight' is defined as BMI-for-age greater than the 95th percentile.

The purpose of this article is to review the causes of childhood obesity, discuss the relevance of obesity to dental disease, and highlight some of the actions pediatricians and pediatric dentists should adopt.

Causes and Consequences of Childhood Obesity:

The etiology of childhood obesity is multifactorial. Childhood obesity presents both immediate and long-term health risks such as orthopaedic consequences, hypertension, hypercholesterolemia, insulin resistance and adult obesity.⁵

Children who are overweight (BMI 85th - 94th percentile) and obese (BMI >95th percentile) are at increased risk for obesity-related illnesses that may emerge in childhood. Childhood obesity remains one of the most precise predictors of adult obesity.^{6,7} The correlation between childhood obesity and adult obesity is stronger for those children who are severely obese, those who have parents who are obese, and for those whose obesity persists further into adolescence.^{8,9} Being overweight during childhood and adolescence has also been associated with increased adult mortality.^{10,11} Obesity in young persons is also related to elevated blood cholesterol levels¹²⁻¹⁵ and high blood pressure¹⁶⁻¹⁸ and some very obese youths suffer from immediate health problems (e.g., respiratory disorders, orthopedic conditions, and hyperinsulinemia. Contrary to popular belief, medical causes (endocrine and genetic disturbances) of childhood obesity are relatively rare, comprising 1-4% of all childhood obesity cases.¹⁹

Unhealthy eating practices that contribute to chronic diseases such as obesity are established early in life; young persons having unhealthy eating habits tend to maintain these habits as they age.²⁰ Thus, it is efficacious to teach persons healthy eating patterns when they are young; high-risk eating behaviors and physiological risk factors are difficult to change once they are established during youth. Furthermore, obese children and adolescents are often excluded from peer groups and discriminated against by adults, experience psychological stress, and have a poor body image and low self-esteem.²¹

Obesity and Dental Caries – A Common Etiologic Basis?

Dental caries is a progressive disease, which, if left untreated, can result in acute infections, pain, tooth loss and under-nutrition followed by time consuming and costly treatment. Although the relationship between obesity and dental caries in children needs further exploration, it is clear that there are *common denominators* that both diseases share.

The true etiology of both obesity and dental caries is complex and multifactorial. Many of the contributing factors are rooted in evolving changes in lifestyle and the internal body as well as external environment. Negative changes in eating, decreased activity patterns, increased frequency of snacking, and increased consumption of fermentable carbohydrates are common in both obesity and caries in children.

The dietary habits of children are a significant contributor to obesity and dental caries epidemics. It is well established that dental caries and frequent ingestion of refined carbohydrates are highly correlated.^{22,23} Sucrose as the ‘arch criminal’ of dental caries is an argument that spans the past 50 years in the dental literature. A key dietary factor associated with increased risk of caries, particularly in children, is the duration of exposure time that fermentable carbohydrates are in direct contact with dental plaque.²⁴ Fermentable carbohydrates include not only sucrose, but all simple sugars (mono- and disaccharides), such as starches found in snack foods. Given the causative relation between refined carbohydrates and dental caries,^{25,26} it is appropriate to hypothesize that overweight might also be a marker for dental caries in children and teenagers.

Simple obesity in children aged 3-15 years is connected with familial and environmental factors, including incorrect eating habits.²⁷ Further, Dye BA et al found that young children with poor eating habits (those eating no breakfast and less than 5 servings of fruits and vegetables a day) were more likely to have dental caries than those with more nutritious eating habits.²⁸

Soft drink consumption too, has been associated with increased calorie intake, increased body weight, pediatric obesity and dental caries.^{29,30} Some studies have shown that children who often consume soft drinks take in 10% more calories and are more likely to be overweight than children who rarely drink them.^{8,29,31,32} Independent of the sugar content, soft drinks and juices also contain acids, such as phosphoric or citric acid, that can demineralize dental enamel when consumed frequently.³³

Reductions in school physical activity programs and increased time in schools dedicated to sedentary activities have resulted in reductions in general physical activity that have been correlated with the

rising incidence of childhood obesity.^{34,35} Increased television viewing has also been shown to result in decrease in fruit and vegetable consumption and increase in non-nutritive food consumption, more snacking, and less meal eating, with the end result being greater calorie consumption overall.^{36,37,38} Dental caries risk may also rise concomitantly due to increased frequency of eating and an increase in the amount of time foods (which often contain fermentable carbohydrates) are in contact with the teeth.

Evidence for the Role of Obesity in Dental Disease

Bailleul-Forestier I et al concluded that there was a significant association between BMI and decayed, missing and filled teeth (DMFT) indices ($P=0.01$) in the severely obese group of adolescents under study. The obese adolescents were more likely to have caries than the non-obese ones.⁵ Similar results were found by Hilgers KK et al that the mean caries average for permanent molars significantly increased with increased BMI, even after adjusting for age and gender.³⁹ A Swedish study examined the relationship between dental caries and risk factors for atherosclerosis in nearly 200 15-year-olds in one small urban community. The study reported that children with a dental decay score greater than 9 had significantly higher BMI values than caries-free children.⁴⁰

Conversely, Macek MD et al found that overweight was *not* associated with increased prevalence of dental caries in either dentition or with dental severity in the primary dentition. It was even more surprising to find that overweight children 6 to 17 years old had a significantly lower dental caries severity than did children of normal BMI-for-age.⁴¹ Similarly, a Finnish study that followed 516 children from birth to age 12 and used weight to predict caries experience. The investigators reported that obesity alone was not a good predictor of dental decay.⁴² Perhaps these findings illustrate that the relationship between overweight and dental caries in children is far more complex than can be explained by carbohydrate consumption alone. These findings might also show that more research should be conducted to address what factors specific to overweight in children might be protective against dental caries in the permanent dentition.

Role of the Pediatrician:

Action on childhood obesity must address factors influencing both eating (energy intake) and physical activity (energy expenditure). As some of the environmental causes of dental caries overlap with the complex multi-factorial causes of obesity, the pediatrician could offer dietary counseling and modification with the goal of both decreasing dental caries and childhood obesity.

The 2003 American Academy of Pediatrics (AAP) Policy Statement on childhood obesity offers insights, making recommendations in 2 categories: (1) child health supervision; and (2) child health advocacy.⁴³

There are 8 recommendations under child health supervision:⁴³

1. Identify and track patients at risk by virtue of family history, birth weight, or socioeconomic, ethnic, cultural, or environmental factors.
2. Calculate and plot BMI yearly for all children and adolescents.
3. Use change in BMI to identify rate of excessive weight gain relative to linear growth.
4. Encourage, support, and protect breast-feeding.
5. Encourage:
 - a. Parents and caregivers to promote healthy eating patterns by offering nutritious snacks, such as vegetables and fruits, low-fat dairy foods, and whole grains.
 - b. Children's autonomy in self-regulation of food intake and setting appropriate limits on choices.
 - c. Healthy food choices.
6. Routinely promote physical activity, including unstructured play at home, in school, in child care settings, and throughout the community.
7. Recommend limiting television and video time to a maximum of 2 hours per day.

8. Recognize and monitor changes in obesity-associated risk factors for adult chronic disease, such as hypertension, dyslipidemia, hyperinsulinemia, impaired glucose tolerance, and symptoms of obstructive sleep apnea syndrome.

The same AAP Policy Statement includes 5 advocacy recommendations:⁴³

1. Encourage parents, teachers, coaches, and others who influence youth to discuss health habits, not body habits, as part of their efforts to control overweight and obesity.

2. Enlist policymakers from local, state, and national organizations and schools to support a healthy lifestyle for all children that include a proper diet and adequate opportunity for regular physical activity.

3. Encourage organizations responsible for health care and health care financing to provide coverage for effective obesity prevention and treatment strategies.

4. Encourage public and private sources to direct funding toward research into effective strategies to prevent overweight and obesity and to maximize limited family and community resources to achieve healthful outcomes for youth.

5. Support and advocate for social marketing intended to promote healthy food choices and increased physical activity.

Understanding and adherence to the AAP Policy Statement can help decrease the risk of childhood obesity and its rise as well as dental caries in the developing child. Genetic, environmental, or combinations of risk factors predisposing children to obesity can and should be identified by the pediatrician through extensive patient and family history regarding diet, physical activity and eating habits of all members of the family chiefly the primary caregiver, usually the mother, who feeds the child. Anticipatory guidance or treatment intervention *before* obesity has become severe will be more successful. Discussions to raise parental awareness should be conducted in a nonjudgmental, blame-free environment. Pediatricians need to actively discuss and endorse healthy eating behaviors for children at an early age and empower parents to promote children's ability to self-monitor energy

intake while providing suitable structure and limitations around eating. Pediatricians may integrate evaluation and anticipatory guidance about diet, weight, and physical activity into regular clinical practice, through an approach that unintended negative psychologic impact on the child's self-concept is avoided.⁴³

Increased physical activity and appropriate caloric intake are recommended for preventing and reducing obesity.⁴⁴ The Centers for Disease Control (CDC) provides guidelines for school and community health programs to promote physical activity among youths address strategies for increasing physical activity among young persons.⁴⁵

Role of the Pediatric Dentist

Pediatric dentists should be familiar with the specific dental and medical findings routinely associated with the obese patient and have a basic knowledge of how to screen for obesity and when to provide referrals to the pediatrician.

This policy statement provided by the American Academy of Pediatric Dentistry (AAPD) Policy on dietary recommendations for infants, children, and adolescents is a useful tool to guide action amongst pediatric dentists. This policy statement encourages the integration of dietary and nutritional recommendations into the age 1 dental visit and the dental home concept, which are fundamental cornerstones supported by the AAPD.⁴⁶ This AAPD policy is most timely and relevant for young children, as underscored in a recently published study that offers new evidence that the first 3 years of life may lay the groundwork for obesity.⁴⁷ In short, the nutritional risk assessment that is integral to the age 1 dental visit may offer health benefits far beyond those related to caries prevention.

Larsson B et al suggested that dietary counseling to adolescents with a high caries score in combination with a moderate obesity can be of advantage in reducing the caries risk as well as the risk for development of CVD at higher ages.⁴⁸ Dietary counseling by pediatric dentists may be centered on assessment of dietary interventions related to:

- (1) Presence of Early Childhood Caries (ECC)
- (2) Frequency of and type of snacking

- (3) Judicious soft drink consumption
- (4) Overall nutrition status
- (5) Levels of physical activity
- (6) Socio-economic status and
- (7) Parent lifestyle (sedentary/active, eating habits, working times)

Generally, a dental history is restricted to oral hygiene concerns and the orientation of the questioning does not give clues to the child's risk of overweight or reasons for obesity if it already exists. The addition of health history questions regarding parental concern about a child's weight or height, diet, hours of television viewing (screen-time), and exercise habits can help the pediatric dentist make a more accurate assessment of a patient's risk for obesity.

Pediatric dentists can also calculate and monitor the Body Mass Index (BMI) in each child's dental record. Calculating and monitoring BMI in dental records is simple once height and weight are obtained. The matter of addressing a child's weight with parents is a more difficult challenge that needs to be based on the comfort level of the dentist. One method may be to incorporate this information into an oral health card that can be reviewed at each recall appointment to call attention to and document clinical findings. Adding BMI to the other dental health information of the child that is reviewed with the parent may be an easier way to objectively present the information. It would also be suitable to refer a high BMI patient to a pediatrician and dietician for consultation.

Pediatric dentists sensitized to the risks associated with improper diet and dietary habits can make a positive impact by encouraging parents to promote healthy lifestyles and dietary habits, while discouraging those poor dietary and sedentary habits which increase the risk of obesity and dental caries.

Conclusion

As members of the pediatric health team, we have a commitment to understand, prevent and intervene in the development of both obesity and dental disease. As clinicians in frequent contact with children and their parents, we also have the perfect opportunity to

do so. Healthy eating patterns in childhood and adolescence promote optimal childhood health, growth, and intellectual development; prevent immediate health problems, such as obesity and dental caries; and may also prevent related long-term health problems, such as coronary heart disease, cancer, and stroke.

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